Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Medicine

journal homepage:www.elsevier.com/locate/apjtm

Document heading doi:

Fauna and abundance of medically important flies of Muscidae and Fanniidae (Diptera) in Tehran, Iran

Mehdi Khoobdel[1], Behroz Davari[2*]

[1]*Health Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran*
[2]*Department of Medical Entomology and Parasitology, Faculty of Medicine, Kurdistan University of Medical Sciences, Pasdaran Street, Sanandaj, Iran*

ARTICLE INFO

Article history:
Received 3 October 2010
Received in revised form 10 January 2011
Accepted 15 February 2011
Available online 20 March 2011

Keywords:
Flies
Taxonomy
Muscidae
Fannidae
Iran

ABSTRACT

Objective: To determine the faunal diversity of Muscidae and Fanniidae flies in Tehran, Iran. **Methods:** A net-capturing by direct observing method and fly trap were used to capture adult flies. To determine the fauna of flies in different habitats, 4 biotopes including corpse (human, birds, livestock), garbage and decaying organic matters, animal carcasses and human indoor habitat were selected. Big hashing nets (95 cm in diameter) have been used for adult flies capture in these biotopes. **Results:** In this study, totally 2 418 adult flies from 8 families including Muscidae, Fanniidae, Calliphoridae, Sarcophagidae, Tachinidae, Syrphidae, Anthomyiidae and Conopidae were captured. Among these, 1 279 belong to Muscidae and Fanniidae families. Four genera and 5 medically important species captured from two above mentioned families. **Conclusions:** Based on scientific documentation, 2 species of *Muscina stabulans (M. stabulans)* and *Fannia scalaris (F. scalaris)* are reported for the first time in Iran. However *M. stabulans* is a cosmopolitan species and its presence in Iran was probable.

1. Introduction

Among insects, flies are medically important to human. Among thousands of species of flies, only a few are common pests in and around the home.

Some of Muscid flies (Diptera: Muscidae), such as housefly, *Musca domestica (M. domestica)* and similar flies, are synanthropic in behavior and have close guild with man and have been implicated as a mechanical vector of numerous pathogens. They feed and breed on filter materials, and disseminating pathogenic organisms through contamination of food and drinks. Hence epidemics of fly-borne diseases are common where human and flies population are in high concentration, coupled with unsanitary conditions[1-2].

Members of the family Muscidae are not generally considered to be of significance in myiasis, but they may be involved as secondary invaders and cause human occidental myiasis in gastrointestinal or urogenital parts of the body[3-4]. The Muscidae family includes 4 subfamilies, Muscinae, Stomoxyinae, Phaoniinae and Lispinae, and more than 100 genera and 3 900 species have been described. In some classifications there is a disagreement especially in family level and subfamilies. Fanniidae family, previously classified as Faninae subfamily as a part of Muscidae, is considered as an independent family in recent years[5,6]. The Lispinae subfamily is not medically important but other subfamilies include some medical species.

Relatively new and small Fanniidae family has 4 genera and 285 species 220 of which are in *Fannia* genus[7-8]. The genus *Fannia* is medically important in this family[9]. Flies of this family are very similar to houseflies but they are smaller and because of this, they are well-known as little houseflies. These flies are more reluctant to enter homes than house flies; instead, they tend to congregate in outdoor areas such as patios, entryways and garages. As temperature declines, they seek cover in buildings or protective vegetation. They seldom land on human foods and are not considered as significant carriers of human disease agents. However, their habit of hovering at face height makes them annoying, though they move readily out of the way when approached. Also Fanniidae flies, in some cases, cause urine-genital myiasis[1,3,4].

Some taxonomical studies on Calliphoridae and Sarcophagidae species and determination of human myiasis cases have been done in Iran[13-15].

In recent years, other studies of flies in Iran, often has been limited to cases reports of myiasis caused by *Lucilia sericata, Oestrus ovis* and *Chrysomya bezziana*[10- 12].

Also a preliminary investigation was done on the fauna of

*Corresponding author: Dr. B. Davari, Department of Medical Entomology and Parasitology, Faculty of Medicine, Kurdistan University of Medical Science, Pasdaran Street ,Sanandaj, P.O. Box: 61177-13446, Iran.
Tel: +98 871 6131293
Fax: +98 87166625131
E-mail: davaribehroz@yahoo.com

Tachinid flies in some areas of Iran[16].

Identification of Muscidae and Fanniidae flies has not been done in Iran, completely. This study was conducted for identification of Muscidae and Fanniidae flies in order to continue and complete the previous studies done in this area.

2. Materials and methods

This is a cross-sectional descriptive and taxonomic study. This study was conducted in Tehran (N 35° 41′, E 51° 25′), which is the largest and capital city of Iran. A bustling metropolis of 14 million people, it is situated at the foot of Alborz mountain range. It has an altitude of 1 200 meters above sea level. Tehran is a city of all four seasons with hot summers, freezing winters, and brief springs and autumns.

In this study only adult medically important Muscid flies were captured and identified. To capture and collect flies, the researcher referred to adult flies habitat, which are mostly in farms, gardens, stockbreeding, garbage and rotting debris, animal excrement, dead animal carcasses and so on in different areas of Tehran. Five different locations in north, south, east, west and center of the city were chosen. A net-capturing by direct observing method and fly trap were used to capture adult flies. To determine the fauna of flies in different habitats, 4 biotopes including corpse (human, birds, livestock), garbage and decaying organic matters, animal carcasses and human indoor habitat were selected. Big hashing nets (95 cm in diameter) have been used for adult flies capture in these biotopes. Fly capturing was conducted in all seasons in favorable days and the average temperature in this period was 22 to 34 ℃. Adult flies collected from various habitats were killed in a cyanide bottle (containing potassium cyanide) and pinned. Each specimen was tagged with the information about host plants or habitat, location and date. To protect the specimens from the insect pests used phenol solution and naphthalene tablets were used. The specimens identified in the Entomology Laboratory in department of Medical Entomology and Vector Control of TUMS (Tehran University of Medical Sciences) by the use of valid fly taxonomic keys.

Systematic Identification: Identification of Muscid flies was done by the use of valid systematic keys and detailed description species[17-21].

It should be notified that main aim of this study was to determine Muscidae and Fanniidae species; therefore other flies were identified up to family level. Exceptionally, the family Syrphidae was determined in genus level.

3. Results

During this study, without considering biotope type, totally 2 418 adult fly including medically important and non important flies were captured. 788 of these flies were captured by fly trap and hand net and 1 630 ones by big net of entomology from different biotopes.

Considering that the captured flies were mostly found in the contaminated areas and habitats of medically important flies, it is natural that percentage of captured medically important flies is more than the percentage of other flies. Among captured flies, without considering biotope and capturing method, 1 278 (52.9%) ones belonged to Muscidae and Fanniidae families, which include 5 subfamily, 4 genera and 5 medically important species. Of these captured flies in this group, only lispinae subfamily is not medically important. From two above mentioned families, Fanninae, Phaoninae and Lispinae subfamilies are being reported for the first time from Iran.

Other flies which were captured in this study included families of Sarcophagidae, Calliphoridae, Conopidae, Tachinidae, Syrphidae, Anthomyiidae and other non medical species with relative percentage of 8.8%, 26.6% 2.7%, 2.0%, 1.1%, 1.7% and 4.2%, respectively.

In this study, 65 (2.7%) flies captured from Conopidae family which are reported for the first time from Iran. These flies have narrow body and are similar to bees. They are metallic green. The Conopidae flies mostly were captured on human and livestock garbles and decaying organic matters, but it is not medically important. This was observable in our study too, although these flies were captured in the biotopes of human and livestock garble and decaying organic matters, they were not found in internal parts of human habitat. It is notable that among captured flies, only Syrphidae family is from Aschiza group and the rest are from Schizophora. In this study 28 (1.1%) captured samples belonged to Syrphidae family which are genus of all specified as Eristalis.

However among 4 genera and 5 species, medically important captured from Musidae and Fanniidae in this study, *F. scalaris* and *M. stabulans* species officially are being reported for the first time in Iran.

However, *Stomoxys calcitrans* which have a worldwide spread and are well-known as dog flies or stable flies; were captured in this study. Also this species has not been officially mentioned in the fauna of Iran in scientific documents.

Detailed description of Musidae and Fannidae species which reported for the first time from Iran:

Muscina Stabulans (Fallen, 1817): During this study, 143 cases (58 female and 85 male) of this species were captured from central regions of Tehran. Tibia and the end of femur are yellow and 4th vein curved in this species. Scutellum in apex is yellow or light brown. The eyes have no hair. Length of the body is 8-9 mm and little bigger than house flies (Figure 1).

Figure 1. *M. stabulans* (Apex is yellow).

Fannia scalaris (Fabricius, 1794): In this study 3 samples including 3 male fly of this species in rural region were captured.

In this species abdomen is completely dark and thorax has two longitudinal dark lines on the back side. In males, on

the inferior of tibia of mid leg, there is a bump with small teeth and in females parafacial has no hair. Length of body is 6–7 mm (Figure 2, 3).

Figure 2. *F. scalaris* (Segment of abdomen is dark).

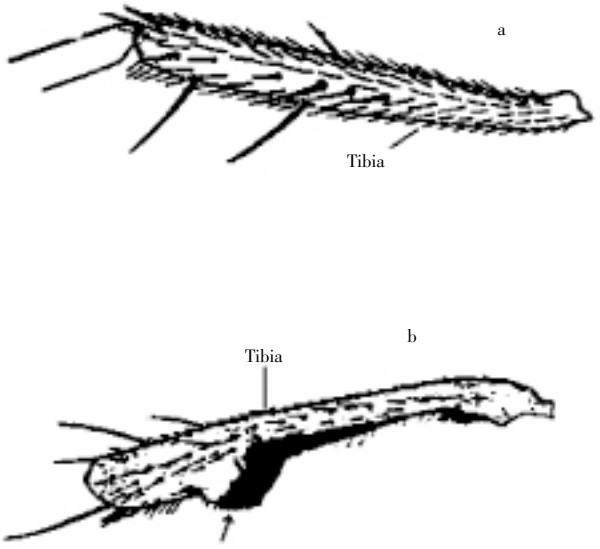

Figure 3. Tibia of mid leg in *Fannia*.
a) *F. canicularis* without bumps. b) *F. scalaris*: Tibia with a bulge in the posterior region.

This species is very similar to *F. canicularis* in flight behaviors and abdomen color especially on backside which is completely black in *F. scalaris*. It is yellow in *F. canilalaris* (Figure 4).

Figure 4. *F. canicularis* (1–3rd segments of abdomen is yellow).

This study showed that *Chrysomya albiceps*, house fly and *Lucilia sericata* are dominant species in the region of study whereas the most dominant species of decaying organic matters and garbage and even human internal habitat is the house fly (Table 1).

Sarcophaga haemorrhoidalis and *L. sericate* among human and animal garble mostly are attracted to birds and human garble and they are not much willing to livestock garble. Other species were often gathered from gardens, parks and human habitat. However among captured species in aforementioned biotopes, some samples were captured from other places.

In this study 8 cases of Syrphid flies were captured which are all identified to *Eristalis* genus level. It is notable that available systematic characteristics in these samples are similar to characteristics of *Eristalis tenax* species which is causing human genitourinary myiasis, but with available facilities and experiences in this filed, certain identification and scientific verification to species level was not possible.

Table 1
Relative abundance of flies in different biotopes in Tehran, Iran.

Species	Number and relative abundance of flies in different biotopes			
	Human indoor habitat	Corpse (human, birds and livestock)	Garbage and decaying organic matters	Animal carcasses
Musca domestica	71 (65%)	519 (72%)	161 (43%)	103 (24%)
Mucina stabulans	0	42 (6%)	45 (12%)	13 (3%)
Stomoxys calcitrans	0	115 (16%)	0	0
Fannia canicularis	11 (10%)	0	0	0
Lucilia sericata	0	9 (1%)	56 (15%)	103 (24%)
Chrysomia albiceps	0	0	19 (5%)	146 (34%)
Others	27 (25%)	43 (4.4%)	93 (25%)	64 (15%)
Total	109 (100%)	718 (100%)	374 (100%)	429 (100%)

4. Discussion

Taxonomic studies among Muscid flies in Iran are very rare. *Musca autumnalis* which is also well-known as face fly, and *F. canicularis* have been previously reported from Iran[22]. Also some restricted and non-documentary reports have indicated the probability of existence of *Stomoxys calcitrans* in Iran which many samples of this fly were captured in animal husbandry and parks of Tehran too and they are reported for the first time from Tehran.

However, in this study existence of another species of this family including *M. stabulaus* and *F. scalaris* was reported for the first time from Iran. It is notable that *M. stabulans* have worldwide distribution but it was not reported documentarily and formally before. Therefore by considering the number of identified species in this study, fauna of medically important Musidae and Fanidae which were reported from Iran reaches to 6 cases.

In the field of Fauna and abundance of flies in different biotopes, it should be noted that the most abundant species in the corpuses biotopes in this study is *Ch. Albiceps* (Calliphoridae). Other studies showed that this species and *L. sericata* (Calliphoridae) are the current fauna of active adult flies in this area and are among the first flies that reach to the corpuses of animal or human. They also hatch eggs on wounds, garble and decaying plants[5,23].

Finally in this study 2 subfamilies 3 genera and 2 species of Muscid flies are reported for the first time from Iran.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

The authors would like to thank Professor Siavash Tirgari (Tehran University of Medical Sciences, Iran) to confirm identification of the flies.

References

[1] De Jesus AJ, Olsen AR, Bryce JR, Whiting RC. Quantitative contamination and transfer of *Escherichia coli* from food by houseflies, *Musca domestica* L. (Diptera:Muscidae). *Int J Food Microbiol* 2004; **193**: 259-262.

[2] Barin A, Arabkhazaeli F, Rahbari S, Madani SA. The housefly, *Musca domestica*, as a possible mechanical vector of Newcastle disease virus in the laboratory and field. *Med Vet Entomol* 2010; **24**(1): 88-90.

[3] Service MW. *Medical Entomology for Students*. 3rd ed. United Kingdom: Cambridge University Press; 2004, p.100-125.

[4] Brown BV, Borkent A, Cumming JM, Wood DM, Woodley NE, Zumbado M. *Manual of Central American Diptera*. Volume 1. Ottawa: NRC Research Press; 2009.

[5] Lane RP, Crosskey RW. *Medical insects and arachnids*. London: Chapman and Hall; 1993, p. 211-228.

[6] Couri MS. An illustrated key to adult males of neotropical *Fannia* Robineau-Desvoidy belonging to pusio sub-group (Diptera, Fanniidae). *Braz J Biol* 2005; **65**(4): 625-629.

[7] Monteiro MR, do Prado AP. Synanthropic flies (Diptera: Cyclorrapha) and their microhymenoptera parasitoids (Insecta: Hymenoptera) at Monte Mor poultry production system, São Paulo, Brazil. *Rev Bras Parasitol Vet* 2006; **15**(2): 49-57.

[8] Forster M, Klimpel S, Mehlhorn H, Sievert K, Messler S, Pfeffer K. Pilot study on synanthropic flies (e.g. *Musca, Sarcophaga, Calliphora, Fannia, Lucilia* and *Stomoxys*) as vectors of pathogenic microorganisms. *Parasitol Res* 2007; **101**(1): 243-246.

[9] Pont AC. The Fanniidae (Diptera) described by J.W. Zetterstedt. *Insect Syst Evol* 2002; **33**(1): 103-112.

[10] Khoobdel M, Mehrabi Tavana A, Vatandoost H, Abaei MR. Arthropod borne diseases in imposed war during 1980-88. *Iran J Arthropod-Born Dis* 2008; **2**(1): 24-32.

[11] Khoobdel M, Jonaidi N, Seiedi Rashti M. Blowfly and flesh (Diptera: Cyclorrhpha) fauna in Tehran, Iran. *J Entomol* 2008; **5**(3): 185-192.

[12] Khoobdel M, Seyedi Rashti SMA, Shayeghi M, Tirgari S. The survey fauna of Calliphoridae and Sarcophagidae flies in Tehran and suburb. *J School Publ Health Inst Publ Health Res* 2004; **8**(2): 79-83.

[13] Shoorijeh SJ, Negahban S, Tamadon A, Behzadi MA. Prevalence and intensity of *Oestrus ovis* in sheep of Shiraz, southern Iran. *Trop Anim Health Prod* 2009; **41**(7): 1259-1262.

[14] Namazi MR, Fallahzadeh MK. Wound myiasis in a patient with squamous cell carcinoma. *Sci World J* 2009; **1**(9): 1192-1193.

[15] Hall MJ, Wardhana AH, Shahhosseini G, Adams ZJ, Ready PD. Genetic diversity of populations of Old World screw worm fly, *Chrysomya bezziana*, causing traumatic myiasis of livestock in the Gulf region and implications for control by sterile insect technique. *Med Vet Entomol* 2009; **23**(Supp 11): 51-58.

[16] Gheibi M, Ostovan H. Preliminary investigation on the Tachinid flies in Fasrs province in Iran. *Plant Prot J* 2009; **2**(1): 140-166.

[17] James MT. The flies *that cause myiasis in man*. Washington: US Government Printing Office; 1947, p. 228.

[18] Chillcott JG. A revision of the Nearctic species of Fanniinae (Diptera: Muscidae). *Can Entomol Suppl* 1961; **14**(1): 295.

[19] Oldroyd H. *Diptera 1: Introduction and key to families. handbook for the identification of British insects*. 3rd ed. London: Royal Entomological Society of London; 1970.

[20] McAlpine JF, Peterson BV, Shewell GE, Vockeroth JR, Wood DM. *Manual of Nearctic Diptera*, 2 Vols, Research Branch, Agriculture Canada, Monographs. No. 27 & 28, 1987.

[21] Pont AC, Werner D, Kachvoryan EA. A preliminary list of the Fanniidae and Muscidae (Diptera) of Armenia. *Zoology in the Middle East* 2005; **36**: 364-378.

[22] Pickens LG, Miller RW. Biology and control of the face fly, *Musca autumnalis* (Diptera: Muscidae). *J Med Entomol* 1980; **17**(3): 195-210.

[23] Lang MD, Allen GR, Horton BJ. Blowfly succession from possum (*Trichosurus vulpecula*) carrion in a sheep-farming zone. *Med Vet Entomol* 2006; **20**(4): 445-452.